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Bakker, R.M.; Cambré, B.; Korlaar, L.; Raab, J.

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# Managing the project learning paradox: A set-theoretic approach toward project knowledge transfer

René M. Bakker <sup>a,\*</sup>, Bart Cambré <sup>b</sup>, Leonique Korlaar <sup>c</sup>, Joerg Raab <sup>c</sup>

<sup>a</sup> Department of Organisation Studies, Tilburg University, P.O. Box 90153, NL-5000 LE Tilburg, The Netherlands

<sup>b</sup> TiasNimbas Business School, The Netherlands

<sup>c</sup> Tilburg University, The Netherlands

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## Abstract

Managing project-based learning is becoming an increasingly important part of project management. This article presents a comparative case study of 12 cases of knowledge transfer between temporary inter-organizational projects and permanent parent organizations. Our set-theoretic analysis of these data yields two major findings. First, a high level of absorptive capacity of the project owner is a necessary condition for successful project knowledge transfer, which implies that the responsibility for knowledge transfer seems to in the first place lie with the project parent organization, not with the project manager. Second, none of the factors are sufficient by themselves. This implies that successful project knowledge transfer is a complex process always involving configurations of multiple factors. We link these implications with the view of projects as complex temporary organizational forms in which successful project managers need to cope with complexity by simultaneously paying attention to both relational and organizational processes.

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**Keywords:** Project-based learning; Knowledge transfer; Inter-organizational project; Temporary organization; Comparative case study research; Project complexity; Qualitative comparative analysis

## 1. Introduction

As more and more industries adopt a project-based mode of operation, project ventures are gaining rapid importance in organization and management science (Engwall, 2003; Janowicz-Panjaitan et al., 2009; Schindler and Eppler, 2003; Söderlund, 2005). Fuelled by the importance of knowledge management for the success of such ventures (Sense and Antoni, 2003; Sense, 2007), a significant line of research on *project-based learning* has emerged (e.g. Cacciatori, 2008; Midler and Silberzahn, 2008; Sense and Antoni, 2003). Project-based learning is generally referred to as encompassing 1) the creation and acquisition of knowledge within project ventures,

and 2) the codification and transfer of this knowledge to an enduring environment (Prencipe and Tell, 2001; Scarbrough et al., 2004). What makes project-based learning salient is the fact that projects seem to have peculiar implications with regard to this process. In fact, available literature suggests that projects present what might be called a “learning paradox”. On the one hand, through their transience and inter-disciplinary nature, project ventures are likely to be very suitable for *creating* knowledge in the context of its application (Gann and Salter, 2000; Hobday, 2000; Grabher, 2004; Scarbrough et al., 2004). On the other hand, however, the temporary nature of projects by the same token seems to inhibit the *sedimentation* of knowledge, because when the project dissolves and participants move on, the created knowledge is likely to disperse (Cacciatori, 2008; Grabher, 2004; Ibert, 2004). It follows from this project learning paradox that one of the crucial challenges for project managers concerns the successful transfer of knowledge created in a project to the wider organizational

\* Corresponding author. Tel.: +31 13 466 2545; fax: +31 13 466 3002.

E-mail addresses: [R.M.Bakker@uvt.nl](mailto:R.M.Bakker@uvt.nl) (R.M. Bakker),  
[b.cambré@tiasnimbas.edu](mailto:b.cambré@tiasnimbas.edu) (B. Cambré), [J.L.Korlaar@uvt.nl](mailto:J.L.Korlaar@uvt.nl) (L. Korlaar),  
[J.Raab@uvt.nl](mailto:J.Raab@uvt.nl) (J. Raab).

context in which it is embedded (Schindler and Eppler, 2003). This challenge is likely compounded in inter-organizational projects, in which multiple organizations work jointly to produce a complex good or service in a limited amount of time and multiple knowledge flows occur simultaneously (Jones and Lichtenstein, 2008). While such inter-organizational project ventures are becoming increasingly prevalent (Bakker et al., in press), we know relatively little of how knowledge transfer is managed in such contexts (Kenis et al., 2009). Therefore, the present article seeks to come to a deeper understanding of the principal factors which determine the success of inter-organizational project knowledge transfer, and discuss its implications for project management practice.

More specifically, our research builds on an in-depth comparative study of 12 cases of knowledge transfer from inter-organizational projects, in order to examine the factors which aid successful knowledge transfer from the project to the involved permanent parent organizations, which are often referred to as project owners (Turner and Müller, 2004). In so doing, we undertook both within-case and cross-case analyses (Eisenhardt and Graebner, 2007). In the within-case analysis, we aimed to come to a thorough understanding of how the factors we identified (relational, cognitive and temporal embeddedness, absorptive capacity and motivation) manifested themselves within real projects (Yin, 2003). In the cross-case analysis phase, we then systematically compared the cases by a set-theoretic Qualitative Comparative Analysis (QCA), essentially looking for patterns that held across the cases (Fiss, 2007; Rihoux and Ragin, 2009). While QCA is becoming increasingly common in organization and management science for analysing an intermediate number of cases from a set-theoretic perspective (for recent applications see Kalleberg and Vaisey, 2005; Kogut et al., 2004; Marx, 2008; Romme, 1995), QCA is quite novel to the research on project management. We believe, however, that set-theoretic approaches have some strong advantages for especially the study of knowledge management in projects, because it allows studying how factors combine into configurations of *necessary* and *sufficient* conditions underlying outcomes (Rihoux and Ragin, 2009). Because projects consist of many interrelated parts, a type of analysis which is sensitive to the potential complexity hereof (like QCA) seems particularly promising to study project knowledge transfer. A key contribution of the present paper, then, is that we study the multiple simultaneous effects of 5 factors on project knowledge transfer. A brief introduction to these factors is presented in the next section. The research question that the present paper aims to answer is: which combinations of necessary and sufficient conditions lead to successful knowledge transfer from inter-organizational projects to permanent project owners, and what are the implications hereof for project management practice?

## 2. Factors influencing project knowledge transfer

By an analysis of existing literature, we identified a number of factors which likely have an effect on learning and knowledge transfer. We deliberately extended the literature analysis beyond the project management field, in order to

capture the general state of the art in organization theory and apply this knowledge to a project venture context. Following Easterby-Smith et al. (2008) we distinguished between *actor attributes* (characteristics of the organizational actors involved in the knowledge transfer) and *relational attributes* (characteristics of the dyadic relation between the organizational actors). With regard to actor attributes, our focus in the present paper is on the motivation of the project sender and the absorptive capacity of the parent organizational receiver, which have been demonstrated to be among the most influential organizational factors impacting knowledge transfer (Cohen and Levinthal, 1990; Easterby-Smith et al., 2008; Van Wijk et al., 2008). With regard to relational attributes, we focus on three dimensions of the relationship between the project and the project parent organizations, its relational (Rowley et al., 2000; Uzzi, 1996), its cognitive (Nooteboom et al., 2007) and its temporal (Lundin and Söderholm, 1995) embeddedness. These three dimensions draw on the work by Scarbrough et al. (2004) on project learning boundaries that can potentially hinder project knowledge exchange.

Although not exhaustive, these five factors are together likely to be strong predictors of the degree of project knowledge transfer. Fig. 1 depicts a model of these five factors influencing project knowledge transfer. We briefly discuss each of them below in separation before we later combine them as necessary and sufficient conditions in the empirical analysis.

### 2.1. Relational embeddedness

The first factor that is likely to be important for project knowledge transfer concerns relational embeddedness. Relational embeddedness refers to the strength of the relation between two or more organizational actors (Uzzi, 1996). In inter-organizational collaborations, such as project ventures, the relational embeddedness of the relation between the project and the parent organization(s) is commonly manifested in the frequency of interaction between the project and parent, and their level of resource commitment (Rowley et al., 2000). Another important indicator of the relational embeddedness of the relation between the project venture and the partnering organizations concerns the level of trust (Moran, 2005), both between the project venture and parents, as well as between the parents amongst themselves. In general, it is likely that strong, relationally embedded ties between the project collaboration and the participating parent organizations (characterised by a high frequency of interaction, trust, and level of resource commitment), lead to a high degree of knowledge transfer, as in such relations a pattern of effortful cooperative behaviour is likely to form the basis for successful learning (Uzzi and Lancaster, 2003).

### 2.2. Cognitive embeddedness

The second factor we distinguish, cognitive embeddedness, or cognitive proximity as this concept is also sometimes referred to, has to do with the extent to which the relation between the parent organization and the project venture is characterised by

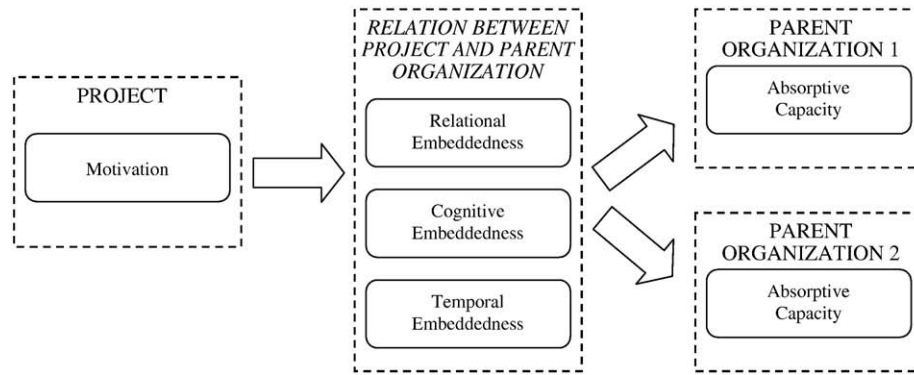


Fig. 1. Overview of factors impacting extent of knowledge transfer from project venture to project owner(s).

“shared representations, interpretations, and systems of meaning” (Van Wijk et al., 2008: 835). It relates to the fact that, for organizational entities to successfully exchange knowledge, they need to have complementary knowledge bases (Nooteboom, 2000). With regard to the relation between cognitive embeddedness and project learning, research has proposed a curvilinear effect (Nooteboom et al., 2007). A certain degree of cognitive embeddedness of the relationship between the project venture and parent organizations is necessary to successfully transfer knowledge, as it provides mutual understanding. When levels of cognitive embeddedness are too high, however, in which case the knowledge bases of the project venture and partnering organizations completely overlap, there is a detrimental effect on knowledge transfer, as there is little “new” to be transferred, even as mutual understanding between the project venture and parents is high (Nooteboom et al., 2007).

### 2.3. Temporal embeddedness

The temporal embeddedness of the relation between the project venture and the parent organizations involved in knowledge transfer pertains to the extent to which the relation between the project venture is “decoupled from [...] past, contemporary, or even future sequences of activities” (Lundin and Söderholm, 1995: 446). Temporal embeddedness thus amongst others relates to whether the parent organizations have worked with one another on previous project ventures in the past, and whether they expect to do so again (Bakker et al., 2009; Brady and Davies, 2004). This has important implications with regard to project learning. For one, when the venture partners have worked together in the past, there is the likelihood that they have created trust, experience and partner-specific knowledge (Bakker et al., 2009). Moreover, when the project venture is part of ongoing collaboration between the venture partners (in which case temporal embeddedness of the relation is high) there are likely routines and structures in place which facilitate knowledge exchange (Schwab and Miner, 2008). Other things being equal, one would thus expect higher levels of temporal embeddedness of the project venture relationship to correspond to higher levels of knowledge transfer.

### 2.4. Absorptive capacity

Besides the three relationship attributes discussed above, we also include two actor attributes. One of these concerns absorptive capacity. Absorptive capacity refers to an organization’s ability to recognise the value of new, external information, assimilate it, and apply it for competitive advantage (Cohen and Levinthal, 1990). In a project venture context, this mainly refers to the partnering parent organizations, which need to identify the value of the knowledge that is created in the project venture, and need to then diffuse this knowledge throughout the organization, so that the knowledge created in the temporary project is more broadly available. It seems that in general, higher levels of absorptive capacity of the parent organization(s) are seen as facilitators of inter-organizational knowledge transfer (Van Wijk et al., 2008).

### 2.5. Motivation

The second actor attribute, and fifth factor overall that is likely to influence the success of knowledge transfer from an inter-organizational project venture to the parent organizations that are involved concerns the motivation of the sender (Easterby-Smith et al., 2008). In most instances, this will likely be the project venture, which should be motivated and willing to share the created knowledge with the parent organizations associated with the project. It will come as no surprise that it has been proposed that, all things being equal, a higher motivation of the sender to transfer knowledge is likely to result in more successful knowledge transfer (Easterby-Smith et al., 2008).

The five factors described above formed the starting point of our empirical field work and data analysis. Herein we aimed to identify whether and how these five factors form necessary and sufficient combinations for causing successful knowledge transfer.

## 3. Methods

As mentioned, one of the central contributions of the present article concerns our set-theoretic approach, which is sensitive to potentially complex combinations of factors that impact knowledge transfer. In order to empirically study project



knowledge transfer, we undertook a qualitative comparative case study (Yin, 2003) of 12 instances of knowledge transfer between inter-organizational projects and the parent organizations involved in them. In the following, we will elaborate our approach toward data collection and analysis.

### 3.1. Data collection

For the purposes of this study, we had access to both quantitative and qualitative data. In a first step, we selected a number of project ventures from a large database of projects, collected by the affiliated authors. This database includes data on 147 inter-organizational project ventures, which was collected among Dutch SMEs through a telephone survey in 2007. A portion of the contact persons in this database had indicated that they would be willing to cooperate in future research. From this group, we made an initial selection of projects, in which we essentially employed a “most similar/most different” strategy (Yin, 2003). That is to say, we selected an initial group of projects that were as similar as possible in some respects (e.g. sector, size) and as different as possible on others (e.g. relational embeddedness; the survey included items on these variables). In a next step, we contacted the individuals listed as contact persons for the project ventures in question and inquired about the projects they had reported on in the survey.

Through this inquiry, we were informed that in the meantime some of the projects the contact persons had been working on had been terminated too long ago for participants to be interviewed. Other contact persons were unreachable, or had moved to different organizations. There was also a group of contact persons that did not want to participate in qualitative case study research, for which we requested some degree of openness from the organization, and the ability to speak to several informants. Despite this, we were at the end of the process still able to successfully study 7 inter-organizational project ventures in-depth. Because these 7 projects were all inter-organizational (including more than one parent organization) we were in most of the selected projects able to study more than one case of project knowledge transfer (elaborated below in Section 3.2).

With regard to sampling, we employed a snowball sampling strategy within each of the 7 project ventures (Miles and Huberman, 1994), meaning that we started with the contact person and subsequently asked informants to provide us with contact information of other people they knew that we could interview. Potential informants were then selected on the basis of whether they actively participated in the project venture and/or parent organization in question. In other words, we made sure all interviewees had insight in the organizational processes within the project, and/or between the project venture and the project owner(s). Moreover, we attempted to overcome one of the downsides of snowball sampling (limited variation between chains of similar informants) by actively aiming to interview organizational actors with diverse roles and positions. Through this process, a total of 21 informants were formally interviewed. These interviews lasted between 45 and 70 minutes, and were

fully tape-recorded and transcribed. Besides these formal interviews, there were face-to-face data gathered through informal conversations with project participants. In addition to these data sources, we obtained documents on each of the project ventures, including minutes of meetings, project evaluation reports, and contracts, which were made available to the researchers. Table 1 presents a brief overview of the central features of each of the 7 project ventures.<sup>1</sup>

### 3.2. Data analysis

In line with the research question underlying this research, the emphasis in each of the studied project ventures lay on the knowledge transfer relations between the project venture and the parent organizations (project owners) involved. On the basis of the 7 projects, we were able to distinguish 12 dyadic relations between the project ventures and parent organizations. That is to say, in five of the inter-organizational projects we were able to study the relation between the project and two parent organizations instead of one (2 dyads). Therefore, we could examine 12 instances of project knowledge transfer in the 7 inter-organizational project ventures that we studied. As mentioned, the main unit of analysis of this research is the knowledge relation between the temporary project venture and the project owner(s). Analytically, therefore, the “cases” in this study are the 12 instances of knowledge transfer between a project and permanent project owner (see Yin, 2003: 23), which are in turn embedded within the 7 project ventures that we studied (which may be viewed as the “classes of events” of which the cases are instances; George and Bennett, 2004: 69).

Our analysis of the data started from a within-case content analysis, aided by standard software for qualitative analysis, namely Atlas.ti. The emergent findings within each of the cases were then compared between the cases, in order to identify similarities and differences. As mentioned, a QCA analysis was employed to facilitate the between-case analysis. More specifically, we employed the most conventional and intuitive type of QCA analysis: crisp-set Qualitative Comparative Analysis (csQCA), using software programme Tosmana (Cronqvist, 2007). Although novel to project management, this particular type of analysis has been widely used and published in organization science (see Kalleberg and Vaisey, 2005; Kogut et al., 2004; Marx, 2008; Romme, 1995). One of the general advantages of QCA is that it combines the strength of qualitative research (in-depth contextualized within-case knowledge) with the strength of quantitative enquiry (formal systematic comparison).

In brief, csQCA pertains to building a dichotomous data table based on within-case knowledge from interviews and documents, and deducing from this dichotomous data table a set of necessary and sufficient conditions leading to a certain

<sup>1</sup> A more elaborate description of the projects is available from the authors upon request.

Table 1  
Characteristics of examined project ventures.<sup>a</sup>

1: Constructing residential area	2: Modernising after-school care	3: Integrating art and education	4: Developing competence based education	5: Constructing train station	6: Developing talent through culture	7: Promoting working in health care
<i>Sector</i> Construction	<i>Sector</i> Service	<i>Sector</i> Service	<i>Sector</i> Service	<i>Sector</i> Construction	<i>Sector</i> Service	<i>Sector</i> Service
<i>Goal</i> Constructing residential area	<i>Goal</i> Modernising after-school care	<i>Goal</i> Combining art and education	<i>Goal</i> Developing educational programme	<i>Goal</i> Constructing train station	<i>Goal</i> Developing talent	<i>Goal</i> Promoting working in health care
<i>Type of knowledge created</i> Variation on existing routines	<i>Type of knowledge created</i> New for the sector	<i>Type of knowledge created</i> New for the sector	<i>Type of knowledge created</i> New for the project	<i>Type of knowledge created</i> New for the sector	<i>Type of knowledge created</i> New for the world	<i>Type of knowledge created</i> Variation on existing routines
<i>No. of project participants</i> 10	<i>No. of project participants</i> 10	<i>No. of project participants</i> 60	<i>No. of project participants</i> 14	<i>No. of project participants</i> 30	<i>No. of project participants</i> 11	<i>No. of project participants</i> 13
<i>Project duration</i> 84 months	<i>Project duration</i> 15 months	<i>Project duration</i> 36 months	<i>Project duration</i> 23 months	<i>Project duration</i> 32 months	<i>Project duration</i> 36 months	<i>Project duration</i> 30 months
<i>Examined dyads</i> 1	<i>Examined dyads</i> 1	<i>Examined dyads</i> 2	<i>Examined dyads</i> 2	<i>Examined dyads</i> 2	<i>Examined dyads</i> 2	<i>Examined dyads</i> <sup>b</sup> 2
<i>Case</i> 1	<i>Case</i> 2	<i>Case</i> 3+4	<i>Case</i> 5+6	<i>Case</i> 7+8	<i>Case</i> 9+10	<i>Case</i> 11+12

<sup>a</sup> In order to safeguard anonymity of the informants, the names and labels for the projects have been changed.

<sup>b</sup> The sum of dyadic relations between projects and parent organizations (1+1+2+2+2+2+2=12) constitutes 12 cases of project knowledge transfer between inter-organizational project ventures and permanent project owners.

outcome, in this case successful knowledge transfer (Fiss, 2007). As this approach is, as mentioned, still quite novel to project management, we will in detail describe how we arrived at our results below.

#### 4. Results

As mentioned, on the basis of the analyses we built a dichotomous data table (see Fiss, 2007), summarising the

Table 2  
Dichotomous data table for combinations of factors underlying successful project knowledge transfer.

Case number	Organizational characteristics					Outcome
	<i>R</i> Relational embeddedness	<i>C</i> Cognitive embeddedness	<i>T</i> Temporal embeddedness	<i>A</i> Absorptive capacity	<i>M</i> Motivation	<i>Z</i> Successful knowledge transfer
1	No	No	No	No	No	No
2	No	No	No	No	No	No
3	No	No	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No
5	No	No	Yes	No	Yes	No
6	Yes	Yes	Yes	Yes	Yes	Yes
7	Yes	Yes	Yes	Yes	Yes	Yes
8	Yes	Yes	Yes	Yes	Yes	Yes
9	Yes	Yes	No	Yes	Yes	Yes
10	No	Yes	No	No	Yes	No
11	Yes	No	No	Yes	Yes	No
12	No	No	No	No	Yes	No

qualitative data we gathered through our comparative study of the 12 cases of project knowledge transfer (see Table 2). Below, we explain how we came to this summarising table, and how we set the dichotomisation thresholds for each variable.

#### 4.1. Relational characteristics

In line with our theoretical framework, we studied three relational characteristics in the cases, namely the degree of relational embeddedness of the knowledge relation between the project and parent organization (R), the cognitive embeddedness thereof (C), and the temporal embeddedness (T). We will discuss each of them below.

The first characteristic we studied in the cases was relational embeddedness (R). Essentially, we coded for each of the 12 cases of project knowledge transfer whether the relation in question was characterised by a high (“yes”) or low (“no”) degree of relational embeddedness. In cases with a high level of relational embeddedness, there is a strong relation between the project and the parent organization, and a high frequency of interaction between them. As is clear from Table 2, cases 4, 6, 7, 8, 9, and 11 are characterised by a high level of relational embeddedness, and cases 1, 2, 3, 5, 10, and 12 with a low level of relational embeddedness. As an illustration, one informant (strong relational embeddedness), mentioned: “We are seen as a reliable, trustworthy partner who is not afraid to make mistakes and who will communicate honestly about it” [Project manager, case 4].

Quotations of such kind indicate that in this particular case, there is strong relational embeddedness of the relation between the project and the parent organization, as there is a certain level of trust between the partners and open and honest communication (Moran, 2005). In contrast, case 2 was an example of a case which was assigned a “no” (weak relational embeddedness) because the project seemed to be totally disconnected from the parent organization. As an example, one informant in this case observed: “We can easily dispose of the project. That will not have big consequences for the organizations” [Manager Theatre Division, case 2]. Similar observations were made by other informants in this case and the other cases where the relation between the project and parent organization was found to be weak (cases 1, 2, 3, 5, 10, and 12, see Table 2).

A similar type of logic underlies our assessment of the other relational factors in each of the cases, namely cognitive embeddedness (C), and temporal embeddedness (T). For determining the extent of cognitive embeddedness of the relation between the project and parent organization, we studied to what extent the relations between project and parent organization in question were characterised by shared representations, interpretations, systems of meaning, and knowledge bases (Nooteboom et al., 2007). The cases that score a high (“yes”) degree of cognitive embeddedness (cases 4, 6, 7, 8, 9 and 10; see Table 2) had at least two of these factors present. From Table 2 can be easily deduced that cases 1, 2, 3, 5, 11 and 12 were, in contrast, characterised by a low degree (“no”) of cognitive embeddedness of the relation between the project and the parent organization. Saliently, from our case analyses appeared that these cases all had in common the fact that there

was a large difference in vision between the projects and the project owners with regard to their time horizon (see Ibert, 2004). Specifically, it seemed that in cases with low cognitive embeddedness of the relation, the project had, in contrast to the parent organization, a short-term focus and time horizon (likely being induced by its temporary nature). It seemed from our cases that when such divergent stances with regard to time horizon were not resolved a high degree of cognitive distance was likely to follow.

With regard to the last relational factor that we identified, temporal embeddedness (T), we studied for each case to what extent the knowledge relation between the project and parent organization was temporally embedded. This state was best indicated by whether there had been previous relations between the people involved in the project and those involved in the permanent organization (i.e. whether they had worked together before through previous collaborations in different contexts). As Table 2 indicates, cases 1, 2, 9, 10, 11 and 12 were characterised by a low level of temporal embeddedness (“no”), as here the actors involved in the project and the organization had no common history together. Cases 3, 4, 5, 6, 7, and 8, in contrast, were characterised by a high level (“yes”) of temporal embeddedness (see Table 2).

#### 4.2. Actor attributes

In line with our theoretical framework, we also studied in each of the cases the degree to which two actor attributes were present: namely the absorptive capacity (A) of the parent organization involved in the knowledge transfer relationship, and the motivation (M) of the project to transfer information. More specifically, as is clear from Table 2, cases 3, 6, 7, 8, 9, and 11 are characterised by high absorptive capacity (“yes”) and cases 1, 2, 4, 5, 10 and 12 by a low level of absorptive capacity (“no”). A case was assigned a high level of absorptive capacity when the parent organization recognised the value of the knowledge created in the project, and had the capacity to diffuse the knowledge outside of the project through the parent.

With regard to the motivation (M) of the project to transfer knowledge, finally, we found that this is generally high in most of the studied cases. Only in cases 1 and 2 the members of the project were not motivated to transfer knowledge (“no”). Saliently, this seems to have been a direct consequence of the tight deadline in these two projects. One informant lamented that “The temporariness of the project caused an ad hoc atmosphere [...]” [Manager Dance division, case 2]. We found that because of the tight deadline of these projects, the participants were so engaged in just completing the project task that they had no time or inclination to think about how some of the ideas they had developed might be preserved after the project would be finished. In cases 3 through 12, in contrast, the motivation in the project to transfer knowledge was high (“yes”).

#### 4.3. Outcome: knowledge transfer (Z)

The main purpose of the analysis is to uncover how the above factors relate to the outcomes observed in each of the

cases with regard to the success of knowledge transfer (Z). We found that 7 cases were characterised by a low degree of success (“no”) of project knowledge transfer (cases 1, 2, 4, 5, 10, 11 and 12), and 5 cases with a high degree of success (“yes”) of knowledge transfer (cases 3, 6, 7, 8, and 9) (see Table 2). This variation in the outcome variable is important, because it allows identifying the factors which are responsible for causing the success of knowledge transfer (Rihoux and Ragin, 2009).

A case was assigned a “yes” score on knowledge transfer (Z) when there were clear indications that the knowledge created in the project had been documented and integrated in the parent organization. For example, one informant stated: “We make sure it [the project’s mission] will also be continued in the organization and that it will be evaluated. At the same time, we make a feedback loop to the team” [Director Primary School, case 3]. In addition, cases with a high level of success of knowledge transfer were characterised by having organized expert meetings and workshops in which members of the parent organization participated.

In the cases which were assigned a “no”, on the other hand, there were few attempts to transfer the knowledge to and diffuse it within the parent organizations. In these cases there was a considerable loss of knowledge after termination of the project. The following informant illustrates: “The best is of course to document the findings so that my colleagues can profit from it, but we are not that far yet [...] if somebody leaves we will lose know-how” [Project Manager, case 1].

Table 2 summarises the assessment of all 12 cases with respect to knowledge transfer and the other factors mentioned above.

#### 4.4. Linking organizational attributes and relational characteristics to knowledge transfer

Having established the presence and absence of the relevant factors in each of the cases, we next present which combinations of the abovementioned five factors lead to successful project knowledge transfer. Although this part of QCA analysis requires the use of some Boolean algebra, the interpretation of these analyses is rather intuitive and straightforward. Moreover, we will in the following keep the use of mathematical expressions to a minimum, and focus instead on their substantive interpretation.

Systematic analysis of the case combinations in Table 2 gives two separate combinations for knowledge transfer, a high condition ( $Z=1$ ) and a low condition ( $Z=0$ ). Based on Table 2, the following formula is then obtained for the “yes” configurations<sup>2</sup> (i.e. leading to successful knowledge transfer, the focus of our analysis):

$$C \cdot R \cdot A \cdot M + T \cdot \sim C \cdot \sim R \cdot A \cdot M \rightarrow Z \quad (1)$$

The above formula should be interpreted as follows. Each of the letters denotes a factor in this study (see Table 2; C =

cognitive embeddedness; R = relational embeddedness, A = absorptive capacity; M = motivation; Z = knowledge transfer). The symbol “+” denotes the logical operator “or”; “.” denotes the logical operator “and”; “~” denotes the logical operator “not”; and “→” denotes the logical *implication* operator (see Fiss, 2007). When one then interprets the formula accordingly, it can thus be deduced that cases that combine a high level of cognitive embeddedness (C) with a high level of relational embeddedness (R), high absorptive capacity of the receiver (A), and a high level of motivation of the sender (M) or cases that combine high level of temporal embeddedness (T), with a low level of cognitive embeddedness ( $\sim C$ ), low relational embeddedness ( $\sim R$ ), a high level of absorptive capacity of the receiver (A), and a high level of motivation of the sender (M) will have a high level of knowledge transfer (Z). As this formula contains some redundancy, it can be simplified by deleting superfluous expressions as follows:

$$A \cdot M(C \cdot R + T \cdot \sim C \cdot \sim R) \rightarrow Z \quad (2)$$

This more simple solution seems to indicate that at first sight, absorptive capacity (A) and motivation (M) seem the most crucial factors in achieving a high level of knowledge transfer. Stated more specifically, on the basis of this first step in the analysis they seem to be *necessary* conditions, meaning that they are always present when the outcome (Z) occurs; i.e. the outcome cannot occur in the absence of these conditions (Rihoux and Ragin, 2009). Second, the above formula indicates that neither absorptive capacity nor motivation, nor any of the other factors, are *sufficient* conditions, meaning that the outcome would always occur when a certain condition is present (Rihoux and Ragin, 2009). Specifically, since none of the factors is sufficient, A and M should always be combined with a high level of cognitive embeddedness (C) and relational embeddedness (R), or with a high level of temporal embeddedness (T), a low level of cognitive embeddedness ( $\sim C$ ), and a low degree of relational embeddedness ( $\sim R$ ). As becomes clear of this rather composite interpretation, this solution is still quite complex. To achieve an optimal solution, it is necessary to allow the software to include non-observed cases, or “logical remainders” (Rihoux and Ragin, 2009: 44). Hence, the 12 cases are considered to be part of a broader zone, making simplifying assumptions on non-observed cases. Using minimisation operators, solution [2] can then be simplified further:

$$A \cdot T + A \cdot C + A \cdot \sim R \rightarrow Z \quad (3)$$

The most important conclusion here is that motivation of the sender (M) fails to remain an important condition for knowledge transfer.<sup>3</sup> The reason hereof is that motivation can be high in cases where no knowledge is successfully transferred (see Table 2; cases 4, 5, 10, 11, and 12). Due to the opposite effects of motivation, it is excluded by the software. In order to again delete

<sup>2</sup> The equivalent formula for the [0] configuration of non-successful knowledge transfer:  $\sim T \cdot \sim C \cdot \sim R \cdot \sim A + \sim C \cdot \sim R \cdot \sim A \cdot M + \sim T \cdot \sim R \cdot \sim A \cdot M + \sim T \cdot C \cdot \sim R \cdot \sim A \cdot M + \sim T \cdot C \cdot \sim R \cdot A \cdot M \rightarrow \sim Z$ .

<sup>3</sup> For reasons of parsimony we do not include the full logical remainder procedures as executed by the Tosmana software.



the redundancy from this formula, formula 3 can be rewritten as:<sup>4</sup>

$$A(T + C + \sim R) \rightarrow Z \quad (4)$$

Formula (4), then, is the minimal model that can be obtained for our data. The following findings can be interpreted from it.

First, absorptive capacity (A) appears to be the only necessary condition underlying successful knowledge transfer. In other words, in order to successfully transfer knowledge from a project to a permanent organization, a high level of absorptive capacity of the parent is always necessary. This implies that absorptive capacity is the single most important factor underlying successful project knowledge transfer.

Second, however, absorptive capacity, nor any of the other factors, appears to be sufficient. That is, in order to achieve successful project knowledge transfer, a high level of absorptive capacity (A) should be combined with either a high degree of temporal embeddedness of the relation (T), or a high degree of cognitive embeddedness (C), or with low relational embeddedness ( $\sim R$ ). The latter factor is somewhat peculiar. From the within-case knowledge that we gained through the qualitative study hereof, we found that this finding relates to only one quite idiosyncratic case (see Table 2: project 3, case 3).<sup>5</sup> Therefore, we decided to focus on the findings that were more broadly shared in our data.

The fact that we find no single sufficient condition to be important, indicates that successful knowledge transfer is never the result of one single organizational factor. It empirically bolsters the argument which has been made more often (e.g. Thomas and Mengel, 2008; Whitty and Maylor, 2009; Williams, 1999), that project knowledge, and the project as temporary organizational form more generally, are complex entities, which cannot be understood by looking at parts of it from a single vantage point. We will elaborate this point in the next section.

## 5. Discussion and implications for project management

Based on our comparative case study of knowledge transfer in inter-organizational projects, we draw two major conclusions, which we will elaborate below. We also discuss the implications of these conclusions for project management, and some of the limitations of the present study.

The first major conclusion of the present study concerns that in order to successfully manage the project learning paradox, one cannot go without a high level of absorptive capacity of the parent organization. In other words, it is necessary for the (project-based) organization to develop an ability to recognise the value of new, external information developed in the project,

assimilate it, and apply it for competitive advantage (Cohen and Levinthal, 1990). The practical implication of this finding unequivocally points to the responsibility of the permanent organization (the project owner) and its functional line management for the successful management of project knowledge. In other words, in order to successfully transfer project knowledge, the parent organization (project owner) should be made aware of the knowledge developed in the project, recognise its value, and be able to do something with it. Running counter to conventional assumptions, the responsibility for successful project knowledge transfer, one might say, seems to lie primarily with the parent organization, not with the project manager.

Based on our data, however, knowledge transfer seems to only work when a high level of absorptive capacity is coupled with a high level of temporal and cognitive embeddedness of the relation between the project manager and project owner. This draws attention to the dynamics involved in what Turner and Müller (2004) and Müller and Turner (2005) have deemed the principal–agency relationship between project management and the project owner. They found that, amongst other things, one of the key roles played in successful project owner/project management relations lies in communication. Our results seem to indicate that besides communication, the temporal and cognitive embeddedness of the relation between project manager and project owner are crucial predictors of the success of knowledge transfer as well, when coupled with a high degree of absorptive capacity of the project owner. With regard to the causal mechanism at play here, we would propose that absorptive capacity works in combination with cognitive embeddedness, because when cognitive embeddedness is high, the parent organization is more likely to be able to assimilate knowledge through their similar knowledge bases (Nooteboom et al., 2007). With regard to the combination between absorptive capacity and temporal embeddedness, we suspect that for absorptive capacity to successfully work, some level of trust and partner-specific experience is needed, which can be accumulated when the project is part of ongoing collaboration (Bakker et al., 2009).

The second major conclusion we draw is that none of the factors we studied are in itself sufficient conditions for successful knowledge transfer. In other words, variation in the success of project knowledge transfer cannot be explained by looking at any of the factors we studied in isolation. This is, in our view, quite an important finding, as it implies that successful project knowledge transfer and its management are inherently complex processes. This conclusion fits the recent stream of research in project management on project complexity, chaos, and uncertainty (e.g. Geraldi, 2008; Thomas and Mengel, 2008; Whitty and Maylor, 2009; Williams, 1999). One of the central features of complex systems thinking in project management and beyond concerns the fact that “the behaviour of a complex system cannot be simply inferred from the behaviour of its components” (Whitty and Maylor, 2009: 305). Such is exactly what we find here, through the use of the QCA methodology (Fiss, 2007). Specifically, our findings imply for project practice that the management of project knowledge

<sup>4</sup> The equivalent formula for the [0] configuration of non-successful knowledge transfer:  $\sim A + \sim T \cdot \sim C + \sim C \cdot \sim R \rightarrow \sim Z$ .

<sup>5</sup> In this project on integrating art and education, the project team consisted mainly of people from cultural institutions. The project was undertaken in one particular school, of which the director belonged to the project team, but not as a core member. The teachers who had to implement the project in their classes, however, did not belong to the project team. Therefore, the relational embeddedness was considered to be low, but this was mainly due to this particular set-up.

transfer should take into account the fact that an intervention in one element of the process should always be accompanied in other elements of the process. One cannot, and should not, manage any of these factors in isolation in order to achieve successful project knowledge transfer. This points yet again to the validity of the argument that projects should correctly be viewed as complex temporary organizational forms (Turner and Müller, 2003; for an overview of this literature see Bakker, *in press*), in which multiple organizational processes interact to cause outcomes (Packendorff, 1995).

Although we stand by the above conclusions and implications for project management practice, we should acknowledge that there are a number of limitations to the present study, as well as directions for future research. First, as an early attempt to apply QCA analysis to project management, our analyses were limited both in the number of cases and the sophistication of analysis. Specifically, our findings are based on a relatively small sample of 12 cases, and we employed a type of QCA which only allows binary data, i.e. dichotomous coding of the presence or absence of certain variables. We are, however, confident that future research will be able to build on our early endeavours here, with larger N datasets (more variables, more cases) and more sophisticated analytical methods (such as multi-value QCA; see Rihoux and Ragin, 2009). Moreover, besides learning as in our application of QCA to projects, there are a wide range of other project related issues which a QCA (i.e. set-theoretic) type of research could contribute to. Consider, for instance, the aforementioned research on project complexity (Gerald, 2008; Thomas and Mengel, 2008; Whitty and Maylor, 2009) of which the core assumption is exactly in line with a QCA type of methodology: that projects are organizational wholes which cannot be properly understood in isolation (Fiss, 2007). But also to the literature on innovation in project-based firms (e.g. Gann and Salter, 2000; Hobday, 2000) provides fertile ground for set-theoretic approaches like QCA. Scholars have realized that successful (product) innovations are likely the result of integration between business processes which are ongoing and repetitive (e.g. routines, R&D, and technical support) and project processes that tend to be temporary and unique (e.g. project-specific knowledge and know-how) (see Gann and Salter, 2000). How these many factors interact in complex configurations, and how they consequently need to be coordinated in order to yield optimal innovative performance, would in our view be a prime avenue for future set-theoretic research on project management.

A second limitation that should be mentioned concerns the dependencies between some of the pairs of cases in our data (those that originate from 1 project). Although clearly less than optimal, QCA, in contrast to regression analysis, does not assume independence between cases. As such, this dependency is a weakness, but not a violation of this study's chosen research method. A third limitation concerns the fact that our research was solely focused on knowledge transfer from the project to the involved project parent organizations. There is, however, very likely a feedback loop at play here, from the parent organizations to the project. This reciprocal process of knowledge exchange rather than transfer was beyond the

scope of our data, but might be a very interesting venue for future research. A fourth and final limitation concerns the fact that the five factors we identified as being important drivers of successful knowledge transfer are likely not exhaustive. There might be other important factors impacting project knowledge transfer that we did not include in our research (such as the degree to which the knowledge was codified, or the absorptive capacity of the project team in the case of reciprocal exchange) but which could inspire future research to further probe into the conditions leading to successful project-based learning.

## 6. Conclusions

The present paper studied the increasingly important subject of project learning in inter-organizational projects. The core message that can be taken from this comparative case study is that, contrary to conventional wisdom, there is a clear and unambiguous responsibility of the project owner (the permanent parent organization) in project knowledge transfer. In other words, the project manager can only do so much. Moreover, managing the project learning paradox should be viewed as a complex process, and by implication, successful project knowledge transfer can never be accomplished by tending to just one organizational factor at a time. Management should be geared toward a multi-dimensional approach in managing the absorptive capacity of the parent organization in combination with a focus on one or more relational variables (temporal embeddedness or cognitive embeddedness). Project practitioners are likely to be successful if they succeed in coping with complexity by simultaneously paying attention to both these relational and organizational processes.

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